

I discussed the situation of benzene migration downgradient in the cobble zone with Mr. Steve Acree, a hydrologist at Kerr Lab. The basis of our discussion can be found in the document:

U.S. EPA. A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/003, 2008.

Our discussion basically is similar to that presented by TechLaw, additional information on each step of the strategy they presented is provided. We recommend:

1) Collection of a synoptic round of Groundwater Levels to Develop Groundwater Elevation Contour Maps under the present condition of pumping from CZ07. This should include all CZ/UWBZ wells in the vicinity of CZ23 and CZ07. This information will help determine if this pumping is influencing groundwater flow at CZ23. If the pump in CZ07 is replaced by one with a higher pumping capacity, as suggested by the June 21, 2018 email from Amec, then the measurements can be repeated to provide additional information on the response of the water table to pumping. However, this information alone cannot confirm that pumping from CZ07 is capturing the extent of the dissolved phase plume. If continuous water level data is collected from nearby wells via the use of transducers, this data may be used to estimate the hydraulic conductivity of the cobble zone. Temperature trend data from the transducers may also be useful due to the large body of heat that remains in the subsurface at this site to help determine the direction of groundwater flow.

(2) Installation of Monitoring Wells Beyond Perimeter Well/Downgradient Wells to determine the current extent of the dissolved phase plume, which now extends past CZ23 (proposed wells 1 and 2 as shown on the attached Figure 3-2, except I would probably move them in somewhat closer, like within 100 feet of CZ23). These wells will help to define the extent of the aquifer that needs to be captured (the extent of the plume that exceeds groundwater criteria for benzene). They can also be used for groundwater elevation measurements that help to determine if the plume is being captured.

(3) Evaluate Extraction at Downgradient Well Locations. Even without the additional information from potentiometric maps, intuitively, pumping from CZ23 should improve capture of the plume that now extends past this well. Pumping from this well (in addition to pumping from CZ07) should begin as soon as possible.

(4) Establishment of Containment Criteria. The above referenced document includes methods to estimate the capture zone of pumping wells knowing the transmissivity (hydraulic conductivity x aquifer thickness) and the pumping rate. This estimate can be confirmed by measuring groundwater elevations. The real test, however, is benzene concentrations in the monitoring wells downgradient from CZ23, showing that the benzene concentrations are declining to below the cleanup criteria. Knowing flushing rates in the area of the downgradient plume may allow estimation of how long pumping will be required to recover the benzene that migrated downgradient.

(5) the baseline benzene data collected in April 2018 clearly shows that benzene at concentrations greater than the MCL exist at the downgradient extent of the thermal treatment area, and thus are migrating away from the thermal treatment area. Benzene concentrations at the downgradient wells remains in most cases orders of magnitude greater than the cleanup criteria. The current sentry wells are in many cases hundreds of feet away from the thermal treatment area, which allows benzene to migrate downgradient for large distances before being detected. Monitoring wells should be installed closer in to the thermal treatment area to allow detection of a loss of the dissolved phase plume in a timely manner, and before it has spread large distances. The recommendations provided by TechLaw are a good start, I would add another well just downgradient from UWBZ30 (which had a concentration of 6000 ug/L in April).